

Remarks/Arguments:

The present invention pertains to a method and apparatus for concentrating organic aqueous solvent mixtures especially plant extracts wherein the plant extract contains water and alcohol in a predetermined ratio. The process involves separating the water/alcohol mixture from the extract utilizing flash evaporation and heat exchange.

One of the problems in using conventional distillation techniques is that the conventional processes employing heat may lead to destruction of or decrease of the active ingredients i.e. alkaloids, phenols etc. That is to say the active ingredients can be negatively affected during the concentration process.

This underlying problem relates to the concentration of a plant extract comprising several active ingredients. These active ingredients are typically either soluble in water or soluble in an organic solvent. In addition, these active ingredients are highly susceptible to destruction by heat or tend to foam in aqueous solutions. All this is to be avoided by the process of the present invention. The term "inoffensive concentration" thus relates to the active ingredient portion in the solution being unaffected or not affected to a degree that would be detrimental to the formulated product. This is confirmed in the last paragraph on page 9 of the specification as filed.

At least one rectifier is placed between the stages of heat exchanger 8. After condensation in a first stage a partially condensed product is obtained. The liquid product obtained from the first heat exchange step is the least volatile constituent of the overhead product. The liquid product from this stage can be withdrawn and can be reused or discharged as desired. The gaseous product from the first heat exchange step is passed to a rectifier between the stages wherein it is cooled and introduced into a second stage of the heat exchanger resulting in a gas and liquid separation. The liquid product of the second heat exchanger comprises the second least volatile constituent from the overhead product, whereas the gaseous product comprises more volatile product(s).

The gaseous product from the second stage of the heat exchanger may be subjected to a final condensation to liquefy the same. Both the liquid product from the second rectification and the liquid product obtained from the final condensation may be re-introduced or reused in the process or may be discharged. Preferably one of the condensates, most preferably the condensate comprising the most volatile component, is recycled to the bottoms product. In that way the process of the present invention makes up for losses of this more volatile constituent from the solution such that the initial ratio of solvents (e.g. water to alcohol) in the solution can be maintained.

Maintaining the ratio of solvent prevents product segregation and foaming. Further, it permits reuse of heat in the condensed overhead product such that the total amount of heat necessary to achieve the concentration can be reduced which in turn lessens the heat stress on the active ingredients in the solution to be concentrated. Reducing the heat stress in turn results in less degradation of the active ingredient(s) in the solution to be concentrated. Thus, there is less change (offense) to the initial concentration.

In a preferred embodiment the process of the invention concerns concentration of a plant extract. In many cases these plant extracts are aqueous alcoholic extracts of a plant material, since many active ingredients of plants are soluble in such mixtures. Depending on

the ratio of water to alcohol and the solubility of the extract, different active ingredients can be obtained. As the ratio is shifted, some of the extracted active ingredients may precipitate from the solution, a result typically not desired. Accordingly, it is desirable in a process used to concentrate active ingredient to maintain the ratio of water to alcohol in the bottoms product substantially constant despite of removing the bulk of the solvent from this solution.

As discussed on page 4 of the specification alcohol is the more volatile compound. The overhead product obtained from flash evaporation will thus typically comprise a larger proportion of alcohol than water, compared to the initial water/alcohol ratio of the solution to be concentrated. This in turn means that the ratio of water to alcohol in the bottoms product is shifted towards higher water contents. To make up for this "greater loss" of the more volatile component (alcohol), the alcohol is recycled to the bottoms product after multi-stage condensation and rectification as discussed above. The ability to keep the ratio of the more volatile to the less volatile constituents or solvents comprised in the solution to be concentrated constant is a core feature and essential to the present invention. This ability permits an operator to lesson any change in character or concentration of the active ingredients during removal of solvents therefrom. This feature also establishes novelty and an inventive step over the prior art as shall be discussed below.

In view of the foregoing explanation and amendments to the specification and claims it is respectfully submitted that the rejection of claims 1-19 and 22-47 under 35 U.S.C. § 112, second paragraph has been overcome and should be withdrawn.

The Examiner has rejected claims 1 and 5-8 under 35 U.S.C. § 102(b) over PCT Application WO 96/26780 (Bauman).

Applicants have amended claim 1 to recite features of the invention that are neither taught nor suggested by the prior art, namely:

- b) "vapor concentration means downstream of said flash evaporated to receive said overhead product;
- c) a multi-stage condenser downstream of said vapor concentration means;
- d) rectification means between said condenser stages; and,
- e) means for recycling at least a part of a condensate from a condensation stage to said bottoms product."

Claim 14 has been amended to describe features of the invention that are neither taught nor suggested in the prior art, namely:

- "A process for concentration of aqueous alcohol solutions having a fixed water to alcohol ratio wherein;
- a) the solution is expanded under vacuum to form an overhead product and a bottoms product;
- b) pressurizing and transporting said overhead product to a multi-stage condenser;
- c) separating said overhead product into a less volatile and more volatile components; and

d) using at least a part of the condensate from at least one stage of said condenser form a bottoms product having a desired concentration for recycle to step a)."

Claim 50 has been amended to describe features of the invention neither taught nor suggested in the prior art, namely:

"A process for concentrating an aqueous alcoholic solution without negatively affecting the properties of the concentrated extract from said process wherein:

a) the solution is expanded under vacuum to form an overhead product and a bottoms product;

b) pressurizing and transporting said overhead product to a multi-stage condenser;

c) separating said overhead product into its less volatile and more volatile components; and

d) using at least part of the condensate from at least one stage of said condenser to form a bottoms product having a desired concentration for recycle to step a)."

Baumann fails to teach or suggest use of rectification interposed between the condensation stages. Without a rectification between the stages of the condenser an efficient separation of the different volatile components would not be possible. Therefore, it is respectfully submitted claims 1 and 5-8 define patentable subject matter and the rejection thereof under 35 U.S.C. § 102(b) is not well taken and should be withdrawn.

The Examiner has rejected claims 1-19 and 22-47 under 35 U.S.C. § 103(a) over Bauman in view of Kramer Sr. (U.S. Patent 4,305,780).

As discussed above the present invention is a process for inoffensive concentration of an aqueous organic solution. The intended product of this process is the concentrated solution and the ingredients thereof. This means that the bottoms product of the flash evaporator is the desired product. This completely distinguishes the process of the present invention from the cited prior art references. It also distinguishes the vacuum distillation plant used for this purpose.

Specifically, both Baumann and Kramer relate to processes and apparatuses allowing recovery of the solvent from a solution. This solvent is desirably obtained as pure as possible for further reuse or other purposes. The bottoms product of the initial evaporation step, however, is considered as waste material and discharged in case of Baumann or is stated to be useful as a fertilizer or animal feed supplement according to Kramer. In neither case no care need be taken about the composition of the bottoms of the evaporator. Contrast this with the present invention which has for a goal to maintain the protection of the bottoms product in the evaporator.

The cited references relate to different types of separation processes to achieve a different purpose, namely separation of solvents, not the inoffensive concentration of the solute in a given solution. Therefore, a worker skilled in the art would receive no hint from either or both references on how to achieve concentration without materially affecting the properties of

the concentrate by using a multi-stage condenser with rectification between stages. Applicant's submit the Examiner is using their teaching to not only select but to interpret the prior art, which is clearly contrary to existing Patent Law. In view of the foregoing it is respectfully submitted the rejection of claims 1-19 and 22-47 over Baumann and Kramer Sr. are not well taken and should be withdrawn.

Applicants do not believe any of the references of record negate patentability of their invention.

This present application is a National Phase Application of PCT/EP 99/07968, which claims priority to German Patent Application 198 49 010.0. To the extent that priority was not claimed in the Declaration this is an error, which applicants will correct by filing a new Declaration in due course.

In view of the foregoing amendments and arguments it is respectfully submitted that the above-identified application is in condition for allowance and a notice to that effect is earnestly solicited.

Applicants are pleased to submit an English Language Translation of the Initial Preliminary Examination Report made of record in the underlying PCT Application.

Respectfully submitted,


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JCS/mc

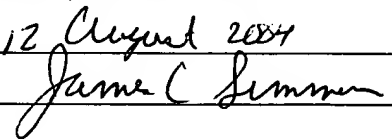
Attachments: Figure 1 (1 sheets)

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